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THE VEGETABLE GARDEN.

BY

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF PUBLICATIONS,
Washington, D. C., March 28, 1899.

SIR: I have the honor to transmit herewith for publication as a Farmers' Bulletin an article entitled The Vegetable Garden, prepared by Mr. C. H. Greathouse, of this Division: There has long been a demand for information on gardening, which the present bulletin aims to give in a few concise suggestions in regard to cultivation and care of the most common vegetables, whether in the farm garden or in the less pretentious garden plot of the city or suburban resident.

In the preparation of the bulletin this Division has been greatly aided by Mr. William Saunders, Superintendent of Gardens and Grounds, who kindly afforded the author the benefit of his wide experience. When completed, the bulletin was submitted to him and has received his approval. Much help has also been gained from Prof. L. H. Bailey's book, Garden-making.

Very respectfully,

GEO. WM. HILL, *Chief.*

HON. JAMES WILSON, *Secretary.*

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THE VEGETABLE GARDEN.

IMPORTANCE TO THE FARMER.

The farm garden probably pays better than any other land on the place. No figures have ever been collected to show of what value its products are, but in the census of 1890 full statistics for market gardens were obtained and from these the conclusion just stated may be argued. The average value of garden stuff to the acre was found to be \$147.17, while for wheat the average was only \$11.65. Later reports show that the average for wheat, corn, oats, and hay is \$7.75 per acre. It seems clear, therefore, that market gardening is more profitable than farming. But the home garden must pay even better than the market garden, for it is not subject to the heavy losses incident to marketing perishable crops. Its products are used directly on the home table and there need be very little waste. It follows that the garden pays better than the field. A good garden will supply half the family's living, and when field crops show a balance on the wrong side it becomes a very important means of support.

In addition to this the garden may be a bountiful source of quiet pleasure. A keener appreciation of such natural joys of the farm home and skill to develop them would do much to repress the craving for excitement which draws young men from country life.

LOCATION.

The garden is frequently under the care of the farmer's wife. It should be in such case as near as practicable to the kitchen, so as to be in easy reach for gathering the vegetables and for fifteen-minute opportunities for gardening. Also all heavy crops, as potatoes, melons, squash, and cabbage, must then be put in the field, where they can be cultivated with horse and plow.

Further, the site should be chosen with reference to sun and wind. A surface that slopes gently to the south is to be preferred, and if the incline looks a little to the east it is the better for it. A woodland or high hill as protection from the north winds and heavy storms is a great advantage, and equal or better will be a wall or hedge judiciously placed as a wind-break. It should usually be on the north or north-west in this country. A wire netting or high paling fence will be needed to keep out the chickens, if any are on the place.

Finally, soil and natural drainage must be considered in selecting the location. A light sandy loam is usually preferred, but fine vegetables are grown with ordinary care on heavy dark soils, on sticky red clays, and on sands apparently no better than the seashore. A mellow rich soil which will hold moisture well is easily recognized, and should be chosen if available; but hardly any soil need be rejected as impracticable until tried. Good natural drainage should be sought. Marshy or even damp ground will call for much labor and expense to make it fit for use. The character of natural drainage can best be determined by observation of the lay of the ground, of the appearance of the soil, and of the vegetation it has borne.

The size of the garden plot should depend on the size of the family and their taste for vegetables; also upon what vegetables are to be grown as field crops. A quarter of an acre is considered sufficient for a garden for a family of four. If potatoes, cabbage, corn, and melons are to be grown in it this estimate is hardly sufficient; but if these vegetables are put in the field, as they should be, usually less than half an acre will be enough, giving room for early potatoes and sweet corn. The best shape is rectangular (see plan, page 11).

DRAINAGE.

When the size and place for the garden have been determined, attention should be given to the drainage, unless it is naturally very good

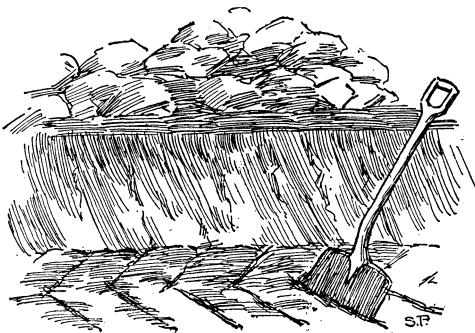


FIG. 1.—Use of spade in ditching.

indeed. The purpose is to get rid of an excess of water, which, left alone, cuts off the supply of air from the roots of the vegetables and stops their growth. The work must be done thoroughly before planting; afterwards no remedy can be found for a failure.

Surface drainage is frequently secured by use of beds raised above the level

of the ground. While this plan has disadvantages, it is commended where no other seems practicable.¹

But really effective drainage must be underground, and tile drains are usually most economical. Where tile can not be had, stones or

¹F. H. Burnette, horticulturist at the Louisiana Experiment Station, writing in Bailey's Garden-making for Southern Gardens, says: "Vegetable seeds of all kinds should always be sown on slight ridges on all but very sandy soils. If the seed be sown on a level bed, as practiced at the North, the ground will become as hard as a turnpike road should a heavy rain occur."

brush may be placed in the bottom of the ditch. For most soils the ditches should be 3 to 4 feet deep and about 30 feet apart. They should have plenty of fall and be carefully leveled at the bottom. When the ditch is ready to fill, sods, straw, or paper should be put over the tile or stones to keep out the loose earth. A ditch can be dug in most soils with a spade alone if the digging is done so as to leave one edge of the spade free, as shown in fig. 1. This method of digging of course gives an advantage also in spading a hard soil for beds or other use.

Trenching will often take the place of drains. This consists of breaking up the soil two spades deep instead of one. From the top a spadeful of earth is thrown out and then the subsoil to an equal depth is cut, but is not taken out and turned over. It is only lifted up a little and allowed to drop back into its place. This must be done, however, in a way to break up the earth thoroughly. Trenching needs to be done only every two or three years. It is especially useful when the subsoil is very hard or comes near the surface. Thorough subsoil plowing renders trenching unnecessary.

PREPARATION OF THE SOIL.

The ground is made ready for planting by plowing, harrowing, rolling, and fertilizing. Spading may be done for a small garden or where special preparation is required for a limited space. The rake is usually employed in finishing off the beds. The soil should be broken fine as deep as the plant roots may be expected to go. This is from 15 to 20 inches. The earth is left fine, loose, and mellow far down, so the tender roots may grow through it freely. It then holds moisture and lies close to the roots, so as to supply them readily with food. The accompanying illustrations from Bailey's Garden-making (figs. 2 and 3) will aid in understanding the breaking up of the soil desired.

PLOWING.

The fall is the time for plowing in any hard or cloddy ground, especially in stiff clays. The clods are left exposed to the frost, which is nature's most effective agent in opening up soil and putting it in order for plant growth. A stiff clay thrown on edge by the plow will break up during the winter into a mass of fine-grained material, almost

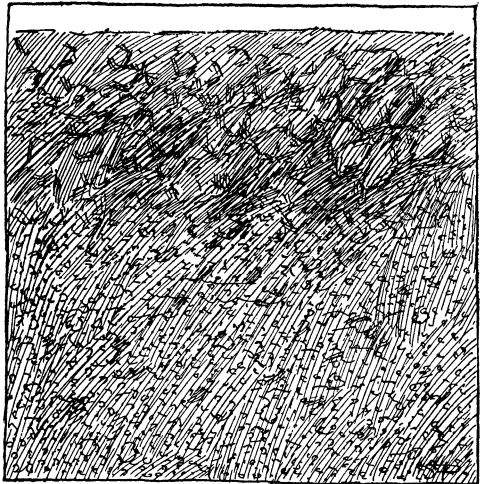


FIG. 2.—Vertical section of soil well prepared.

as open as sand and well adapted to growing vegetables. But if the breaking is left till spring, or if the ground broken in the fall has become compacted during the winter, the plow should be set deep, and harrowing and rolling continued until a fine, loose condition is secured. As a rule, two plowings will be better than one and three better than two. Prepare the soil thoroughly before planting. Neglect of this will be felt all through the season. After the plants are growing it is too late to work the ground beneath them.

The time to plow in the spring is as soon as deep freezing has ceased and the ground is in condition to be worked. The proper condition for working can be determined by squeezing a little of the soil in the hand. If it makes a ball, and sticks to the hand, it is too wet; if it breaks

hard, it is too dry. To work well, either for plowing or hoeing, it should crumble easily and finely, and leave very little dirt on the hands.

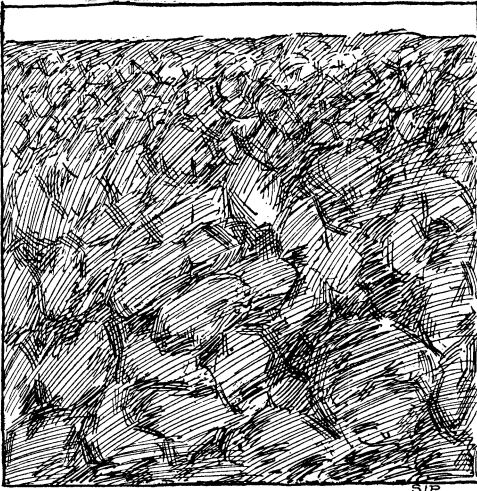


FIG. 3.—Vertical section of soil poorly prepared.

USE OF FERTILIZERS.

Of leading importance in preparation of the ground is the supply of plant food, of which the chief essentials are nitrogen, phosphoric acid, and potash. It is important that any fertilizer used to supply these elements should be thoroughly distributed through all the soil to be reached by the roots of the plants, and this

distribution must be completed before planting. Turning and returning the ground and harrowing again and again are useful for the purposes.

A wise selection of fertilizers can not be secured by rule; it is very largely a matter of experience. A sandy soil is often deficient in the essentials of plant food, while a clayey soil contains them in abundance, especially potash. A limestone soil is likely to contain a considerable proportion of phosphoric acid. What is good fertilization on a given soil for one crop may be very unsatisfactory for another. Where it is the purpose to establish a garden permanently, it will be profitable to determine the need of the soil for fertilization by close observation of results from year to year. It will be well to make notes of important points. Not only will the facts thus gained be useful for future gardening, but they will often find application in the larger operations of the field.

Most soils are benefited by the addition of humus, a name applied to

any thoroughly rotted vegetable or animal matter. Humus may be known by burning a small quantity of soil on a red-hot shovel. If it gives an odor of feathers, it contains humus from animal matter; if an odor of straw, it contains humus from vegetable matter. Humus forms the richness of nearly all good land, and rarely is there too much of it. In close-grained, sticky soils, which have a tendency to bake, the humus produces a looser texture and a better balance in the retention of moisture. On a loose and leachy soil it brings the grains closer together and promotes chemical activity. At the same time it supplies plant food. Leaves, garden refuse, and barnyard manure made into a compost and allowed to decay make good humus. The pile must be turned over several times each year until it is thoroughly broken up into a mass of even texture.

Lime may be very often added to a soil with good results. It corrects acidity, makes clay soil more friable, and holds sand closer together.

The time for putting on fertilizers depends upon the character of the soil and of the fertilizer. Stable manure may be spread evenly over the surface a short time before the first plowing. It is generally stated that manure should be thoroughly rotted or "short" when applied, but it is considered a good practice to haul it directly from the stable during the winter and scatter it on the ground where it is to be used. In this way the liquid portions are more fully available. The principal advantage in rotting manure before applying it is that the rough litter, the straw, etc., is well broken up, and so the mechanical condition of the soil is improved by its application. The crop to be grown must often be considered in determining how thoroughly rotted the manure should be. It must be remembered that it takes more time for vegetable tissue to be broken up than it does for animal tissue.

Wood ashes are a common and ready source of potash, and in addition improve the mechanical condition of most soils. The lime in them tends to correct "sourness" and to promote the important chemical process of nitrification. Ashes are usually found to render light, sandy soils more moist. Cotton-hull ashes are also very useful, furnishing potash and phosphoric acid.

A valuable means of improving the soil is by growing clover and cowpeas and turning them under. Benefit is also derived by growing peas and beans and other leguminous plants. They collect nitrogen about their roots and it is left in the soil.

Some commercial fertilizers are harmful to certain crops, and care must be taken by inexperienced persons that a wrong use is not made of them. Chemical fertilizers may be applied much nearer the time at which they are to be used by the plant. Bellair, a French authority, says for deep-rooted plants, fertilizers should be put on in the spring before breaking the ground; for shallow-rooted plants, after breaking.

Fuller details as to improvement of soil may be found in the follow-

ing Farmers' Bulletins: No. 21, Barnyard Manure; No. 44, Commercial Fertilizers; and No. 77, Liming of Soils.

SUPPLY OF SEED AND YOUNG PLANTS.

Seeds should be ready by the time the ground is prepared. It is usually considered enough to send to some reputable dealer and depend upon him for quality. But it is so important to have good seed and mistakes are so easy that careful examination of the seed some time before planting is advisable.

QUALITY AND QUANTITY.

It has been found by experiment in the Department of Agriculture¹ that large, heavy seeds produce stronger plants than do small, light seed. It is always a mistake to plant old seed, and often it is well to procure a supply from a different part of the country, but not very remote nor too different in climate. In this way the tendency of cultivated plants "to run out"—i. e., to go back to the wild state from which they have been improved—is counteracted. Seeds of weeds that are hard to kill out are sometimes found in field and garden seeds and precautions must be exercised against them.

The quantity of seed to be used will depend of course upon the amount of ground to be planted, and that again varies with the size of the family and their preferences among vegetables.

A quantity necessary to sow a fixed length of row is stated at the end of directions for soil and cultivation of various vegetables as given on page 15 and following. Reference to this will be helpful in determining how much seed to provide. It is better to have too much than too little.

PLANTS FROM THE HOTBED.

Many vegetables, as tomatoes and cabbage, must be started in the hotbed and the plants reset once or twice. Such plants can usually be purchased of seed dealers or experienced gardeners in the neighborhood. Enough for a small family may be started in a good-sized box of earth in a south window. But a hotbed (fig. 4) and cold frame are not hard to make. They should be located in a sheltered, dry place, such as a gentle slope on the sunny side of a barn.

The essentials for a hotbed are bottom heat, protection on all sides, and a sash of glass as cover. The heat is usually supplied by the fermentation of horse manure. The manure should be taken fresh, with about half as much of the straw or litter used as bedding as there is of manure. It is piled in a long heap about 4 feet high with the top level. If kept under cover, the manure will be more effective. The pile

¹ Yearbook, 1896, p. 305.

should be rather narrow for convenience in handling. If fermentation does not start readily, wetting with hot water will start it. The heap should be turned several times at intervals to insure uniform fermentation. In turning any lumps should be broken up and the warmer portions mixed through the heap. When the fermentation has well filled the entire heap, the hotbed may be made.

The pit for the hotbed is 1 to 3 feet deep. It may well be built for permanent use, and then brick walls are economical. Board walls are as good as long as they last. Good drainage is essential. The pit should be filled with litter during the winter to prevent freezing on its inner surface. This is especially true if plants are to be started in winter. The litter is thrown out when the time comes to make the bed. Then an inch or two of coarse stuff is put at the bottom, and upon this 18 inches to 3 feet of manure is placed. Next comes a layer of leaf mold and on top 4 or 5 inches of fine garden loam.

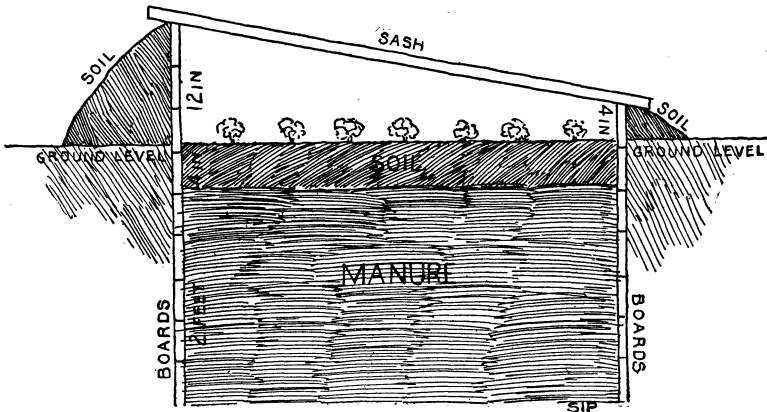


FIG. 4.—Section of hotbed.

The manure should be trodden down in layers about 6 inches thick. If it is loose and fluffy after being trodden, there is too much straw in it; if it packs soggy and solid under the foot, there is too little straw. It should feel springy when trodden, but should not swell up quickly in a loose mass when released from pressure. A hotbed with 2 feet of manure in it may be expected to be good for six weeks.

Mr. William Saunders, for thirty-four years Horticulturist of this Department, prefers that the pit beneath the hotbed should be only a foot deep, leaving most of the manure above ground. Otherwise the heat is drawn off by the cold earth. It is the practice of some gardeners to make the bed entirely above ground. In that case the frame should be at every point about a foot inside the edge of the manure heap. This form gives an opportunity to add to the sides of the bed when the heat begins to decline.

The frame in either case faces south, and is 6 to 8 inches higher at the back than in front. It is covered with a sash slanting to the front

to shed the rain, and so placed that it may be raised or pushed aside to allow ventilation. This sash can usually be bought ready-made $3\frac{1}{2}$ by 6 feet in size, and this fixes the size of one section of hotbed.

Experience enables the farmer to judge by the warmth to his hand when it is time to plant seed in the hotbed. If a thermometer is used, 90° is the temperature for planting tomatoes and other plants requiring much warmth, while 70° to 80° will suffice for others. Not all kinds of seed are to be sown in the hotbed at the same time. Attention must be paid to the time at which transplanting must be done. When the plants are ready to go to the cold frame it is a loss to leave them in the hotbed. But if it is still too cold for them out doors a loss will occur by removing them. Care must be taken not to allow the bed to become too hot when the sun comes out suddenly, and to give plenty of fresh air. Whenever the temperature is above freezing the sash may be removed part way. Water should be given as needed, but in the morning, not at night.

A cold frame is about the same as the top part of a hotbed. No bottom heat, and therefore no manure, is necessary. It is used for starting plants in early spring, for receiving partially hardened plants which have been started earlier in hotbeds and forcing houses, and for wintering young cabbages, lettuce, and other plants. The boxing need not be so carefully constructed as in the hotbed. In fact, any sort of rough protection to plants is in the nature of a cold frame.

PLANTING.

The time for the first planting in any locality is only known by experience, if early vegetables in the open air are sought. The blooming of the peach is assigned as a time for seeds that will germinate in a cold soil and resist a slight frost. Among these are peas, spinach, and onion. When the oak leaf breaks from its bud is suggested for beets, turnips, corn, and tomato. Seeds that thrive only in warmer soil, as beans, cucumber, canteloupe, watermelon, squash, and okra, may be planted when the blackberry is in blossom. The planting must be made, of course, with due consideration of the date when the vegetable is expected to be ready for use, and if a continuous supply is desired through the season several plantings at different dates must be made. These are known as successional plantings. An estimate of the number of days from planting to use is given in directions for culture, page 15 and following.

The garden should be planted, when it is practicable, so as to allow cultivation by plowing. Where this can not well be done, wheel tools will be found a great advantage. Usually there must be some hand weeding, but it should be reduced to a minimum. For this reason the rows should be long and continuous. If enough of one kind of vegetable to make a long row is not wanted, several kinds may be put in the

same row. The accompanying illustration (fig. 5) from Bailey's Horticulturist's Rule Book furnishes a plan for such planting as is sug-

6 ft.	6 ft.	4 ft.	4 ft.	3 ft.	3 ft.	2½ ft.	2½ ft.	2½ ft.	4 ft.	4 ft.	4 ft.	4 ft.	6 ft.	8 ft.	8 ft.
Asparagus.	Rhubarb. Artichoke.	Parsnip. Salsify. Cucumbers, followed by fall spinach.	Peas.	Early potatoes, followed by celery.	Early cabbage and cauliflower.	Beets.	Lettuce, early and late. Winter radish. Endive. Parsley.	Onions, with early radish.	Bush beans.	Late cabbage.	Early corn and summer squash.	Late corn.	Tomatoes and pole beans.	Musk and water melon.	Winter squash.

FIG. 5.—Tracy's plan for kitchen garden.

gested. The rows are about 100 feet long. It will be convenient to have two narrow footpaths across the garden, dividing it into thirds, but

these need not break the rows so that they can not be plowed or otherwise cultivated throughout their whole length without turning. The direction of the rows east and west is preferred by some.

MARKING THE ROWS.

Various devices have been suggested for marking the rows for planting. A roller, which will serve at the same time as a marker, consists of a smooth, hard-wood log with heavy rope secured firmly about it at distances corresponding to the intervals desired between the rows. When plants or seeds are to be dropped at intervals, the places may be marked by knots in the rope. A roller may be made of a sewer tile by knocking off the collar and filling the hollow with cement. When a marker is not available, the row may be opened with a hoe. A line should be employed to keep the rows straight and parallel to each other; the better results will more than repay the extra trouble.

CONDITION OF THE SOIL.

The soil should be moist when the seed is put in it. Many persons prefer that the planting should be done just before a rain; but in this practice care must be taken against the baking of the soil over the seed. It is usual to firm the earth above the seed by patting it lightly with a hoe or walking over it placing one foot close after the other. This is to make sure that the soil is brought close against the seed. Small, weak seeds must not be put in ground that bakes or is not thoroughly prepared. It is well to sow some large seed of vigorous growth, such as radish or turnip, with celery and other small weak seeds. The added seed come up, breaking the crust, so as to let out the weaker plants. Also they show where the row is, and this makes way for cultivation before the crop is up. Of course the radishes or turnips must be pulled up as soon as the other plants appear. Celery and other seeds that germinate slowly should be shaded.

Most seeds must be sown much more thickly than the plants can be profitably grown. If they come up well thinning is necessary, and this should be done, as a rule, as soon as the first true leaves appear. In thinning care must be observed not to loosen the roots of plants that are left.

DEPTH OF PLANTING.

The depth of cover depends upon the size of the seed, its habits of germination and early growth, the soil, and the season of planting. Planting too deep is a frequent cause of failure to come up. Warmth, air, and moisture are necessary to germination. In the spring moisture is usually abundant, while warmth is lacking. The soil is warmest near the surface. Accordingly the cover should be shallower than in summer, when warmth is abundant and moisture is lacking in the surface soil. A clay soil admits air and warmth less easily than does a

sandy soil, and therefore allows less covering. Small, weak seeds should have less cover than large, vigorous seeds. Some kinds, as celery, must be merely pressed into the soil, and have a little sand or dust scattered over them.

Soaking the seed may prove injurious if continued too long, but there is advantage in the case of kinds that are slow to germinate, such as beet, carrot, and parsnip. Also thick skins, as of beans, are loosened by soaking, and the plants will come up probably a day or two earlier.

TRANSPLANTING.

The time for transplanting from the hotbed or cold frame is usually soon after the formation of the first true leaves. The weather should be cloudy or rainy and the ground into which the young plants are to be put should be in the best of condition. The earth should be pressed closely about the roots of the plants in their new place, and if the sun comes upon them they should be shaded with large leaves, shingles, or stones. Small plants may be shaded with screens folded from paper and held in place by stones. If the leaves of the young plants are clipped off about half-way back from the point, the evaporation from them will be lessened that much and the roots will have an opportunity to establish connection with the soil and secure ample moisture before the full demand from the leaves is renewed. By this the plants' chances for living will be materially increased.

Some plants bear transplanting much better than others, but any plant can be removed from place to place at will if the mass of earth about the roots be preserved nearly unbroken in the process.

ROTATION.

Of course the same vegetable should not be grown year after year in the same part of the garden. A proper rotation is comparatively as important in the garden as in the field. Investigation has shown that beans, peas, and other legumes collect nitrogen from the air and leave it in the soil. It follows that deficiency of nitrogen may be supplied by growing leguminous crops, and they may be followed by other vegetables that especially need nitrogen.

Among suggestions for rotation are the following: Lettuce may be succeeded by beans and tomatoes; beans by turnips, radishes, or celery; peas by cabbage or celery; beets by spinach, lettuce, or okra; onions by turnips, peas, beans; cabbage, okra, celery, squash, melons, or cucumbers by beans or peas; corn by melons, cucumbers, squash, beans, or peas.

CULTIVATION.

The chief purposes of cultivation are to keep down the weeds and to maintain in the soil a supply of air and moisture favorable to plant growth.

The moisture in the soil about a vigorous plant is rapidly carried away by evaporation from the leaves. As long as the ground contains an ordinary water supply for several feet below the surface a steady flow of moisture goes upward through the minute spaces between the soil grains. The upper layers of soil are kept from becoming dry by this flow. But when the rainfall is scant the moisture in the lower soil also becomes exhausted and the plant curls up and dwindles. A drought prevails. The gardener must provide against the occurrence of this condition. It is not enough to remedy it; he must prevent it. One of the most efficient means is a mulch, which is most conveniently made of the surface soil.

TIME FOR THE SOIL MULCH.

Usually as soon as a rain is over the atmosphere is free of moisture, and evaporation from the soil sets in. The water that has just soaked in comes up through the little pores between the soil grains and passes off from the surface of the soil into the air. The gardener's aim with the mulch is to save this moisture and send it through his plants. If the little pipes or tubes formed by the pores of the soil are broken, the flow through them is checked and evaporation from the ground is much lessened. It is only necessary then in order to save the moisture for the plants to break up the surface of the soil with a rake or other implement.

It is a serious mistake to suppose that so long as the surface remains moist the soil below is well supplied with water. A damp surface may mean only that moisture is rapidly evaporating into the air. As often as the surface becomes solid it should be stirred with a rake or hoe. As a rain or even a shower compacts the soil at the surface, the common notion that it renders raking or shallow plowing less necessary is precisely contrary to the fact. It is then especially that the surface should be broken. The same is true after irrigation. The raking or plowing should be done as soon as the soil will not cake when squeezed in the hand.

IRRIGATION.

But frequently dry weather continues so long that it is impossible to preserve sufficient moisture by tillage or any sort of mulching. It then becomes necessary to water the garden. Where there is connection with city water works the supply is ample and easily reached. In other locations various forms of cisterns and reservoirs are employed. When it is possible the reservoir should be a few feet above the level, so that any part of the garden can be reached with a hose or a V-shaped trough. The proper application of water appears to be very simple, but is in fact quite difficult.

It is not unusual for an inexperienced person to sprinkle the garden every day or two and think he is relieving the drought. The effect of such treatment is likely to be harmful, especially if the sprinkling is

allowed to leave a crust about the plants. In watering, the earth should be thoroughly wet, so that the moisture will get to the lower and outer roots of the plants. In order to check evaporation after sprinkling, the surface should be broken as soon as dry enough to work. The watering should be repeated when it is evident, upon careful watching, that more moisture is necessary. It must be remembered that the small, active roots, which take up moisture and plant food, are most numerous at the extremities of the large roots and at a distance from the stem. The water must be so given as to reach these small roots.

The best time for watering is generally thought to be at evening, but Bellair says: "In the spring, in the middle of the day, because the morning and evening are too cool; in the summer, at evening because the days are so hot that a great part of the water given during the day would be evaporated immediately; in autumn, in the morning, because the nights are cold."

Mr. Saunders says: "Water at any time when the plants need it, and water thoroughly. When I am told that watering in the sunshine at noon will burn up my plants, I answer that the plants will certainly burn up if I do not water them."

KILLING THE WEEDS.

Weeds will be most troublesome when rain is plentiful. The plow and hoe ought to be depended upon mainly. Hand weeding is necessary in some cases, but is always slow and tiresome. Various forms of cultivators and wheel hoes are in use and have many advantages over the ordinary field implements. Also, there are several forms of hand hoes made to cut just below the surface and kill the weeds more effectually and rapidly than the ordinary hoes will do.

Several kinds of grasses are the hardest to deal with when once they get set in the ground. The worst of these are witch grass, or couch grass, and Johnson grass. Sometimes very troublesome but less important are crab grass, Nimble Will, and Bermuda grass. The thing to do with these is to see that they are well killed out before the garden is planted and not to allow them a start afterwards.

INSECTICIDES.

Various forms of insecticides are used to kill cabbage worms, potato bugs, and the like. Farmers' Bulletin No. 19 gives directions as to the preparation of many of these. Hand picking of worms and brushing bugs off the plants into baskets are primitive means of protection, but sometimes prove the most practicable and most effective. A flock of turkeys often proves to be of great assistance against insects.

SPECIFIC DIRECTIONS FOR SEVERAL VEGETABLES.

Artichoke.—The Jerusalem artichoke (fig. 6) in a deep, favorable loam, well prepared, will produce at the rate of 300 to 600 bushels to the acre.

Two or three tubers, if small, are planted in a hill. The hills are 3 feet apart each way. Cultivation is necessary if good results are desired, but the plant will produce without any care whatever. The tubers are ready for use early in October and may be dug at any time when the ground is not frozen until late in March. Freezing does not affect them and they come to the table fresh from the earth in the early spring when other vegetables are likely to be stale and musty. They are boiled or steamed till soft and served with cream sauce; they are also used as salads or pickles. They have about the same food value as potatoes. A pint of tubers, cut to eyes as potatoes are, will plant 25 to 30 hills.

Asparagus.—This vegetable is one of the earliest to be ready for use. A fertile soil is best, but any good ground thoroughly prepared does well. Fine sandy soil makes the plants gritty. Sow early, in rows 3 feet apart; cover rather lightly

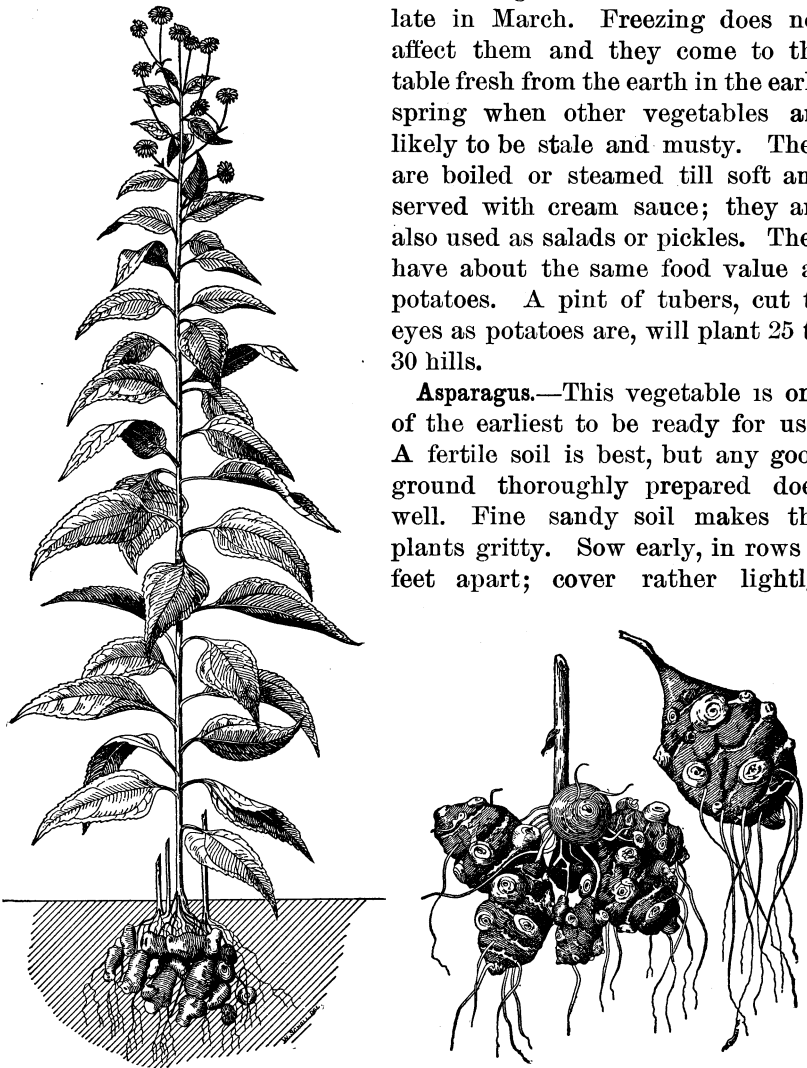


FIG. 6.—Jerusalem artichoke, whole plant and tubers.

Thin when 3 or 4 inches high to 1 foot in the row if the soil is strong; farther apart on a sandy soil. Cultivate carefully, and supply a good dressing of well-rotted manure each spring. The plant should grow vigorously. It will be ready for use in the third year, and should be cut until late in June. It should then be well worked and left to grow

to gather strength for the next year's crop of shoots. When the tops begin to die they should be cut and burned. The asparagus on the market is usually white, except a small tip, and the white portion is stringy and inedible. This is the result of deep setting and cutting. If the seed is planted as here directed and the shoots cut a little below the surface when 2 to 3 inches high, a dish considered by many persons to be more satisfactory will be obtained. Two and one-half ounces of seed will sow 100 feet of row. A year may be gained by purchasing the young plants a year old and setting them out 4 inches deep. For details on asparagus growing see Farmers' Bulletin No. 61.

Beans.—A light, loose soil, fertile and well prepared, will give the best results for snap beans, and the crop will be the earlier for a considerable per cent of sand; but a fair return may be expected from almost any soil with ordinary care. Sow as early as frost will permit in drills $3\frac{1}{2}$ feet apart and cover 1 to 2 inches deep. The plants should stand 5 to 7 inches apart in the row. The tillage should be with a horse cultivator. If the space is small the rows may be 8 to 12 inches apart. The plants should not then be quite so close in the row, the supply of fertilizer and water a little more generous, and a wheel hoe should be used in cultivation.

Beans will be ready for the table in six to eight weeks from planting. If wanted very early they can be handled successfully from the hotbed. All green pods should be picked as soon as seed begin to form. By a judicious selection of kinds a succession can be secured without delaying the planting. One quart sows 100 feet of drill.

Lima beans are planted in drills 3 feet apart and allowed to stand 20 inches apart in the row. The beans should be placed with the eye down and covered 2 inches deep. Pole beans, both snap and lima, must be planted later than the dwarf varieties, as they are more easily injured by frost. Three or four plants should be left in each hill. One pint sows 100 hills. Ready for use, lima in 90 days, pole in 110 days.

Beets.—Loose, rich soil with considerable sand is desirable, but beets will grow well in any except a hard, heavy clay. The seed should be planted about an inch deep in drills $3\frac{1}{2}$ feet apart. The sowing may be quite early, as the plants will stand a light frost. When growth has fairly begun thin to 6 or 8 inches in the row. The plants removed may be used as greens. Turnip or globe-shaped are liked best for summer use; the long varieties for winter keeping. Leaf blight is occasionally troublesome in beets and may be met by spraying with Bordeaux mixture.¹

Winter beets are sown in July and August, and after frost are taken up, the tops cut off, and the roots stored in the cellar. One ounce of seed will sow 60 to 70 feet of drill. Early varieties may be used in 50 to 60 days; the roots will be mature in 150 days.

Cabbage.—The best soil is a deep, rich loam, well worked. Positions

¹ See Farmers' Bulletin 19. Some Important Insecticides, p. 7.

shaded during part of the day are to be avoided, for cabbages require abundant light and warmth. A liberal amount of stable manure or other proper fertilizer will make good returns.

The young plants should be started early in a hotbed and transplanted. Usually they must be kept for a time in the cold frame before being finally set in hills 3 feet apart. It is best to wait for a rain before setting out, but shallow drills may be made and soaked with water over night. A light mulch should be applied to the plants when set. In dry, hot weather water should be given liberally and the plants shaded carefully with boards or leaves.

Cabbages have several enemies, which will destroy the crop if left alone. Among these are root maggots, against which slips of tarred paper have been used successfully; cabbage worms, which may be destroyed with pyrethrum or kerosene emulsion, and club root, for which there is no known remedy.

One ounce of seed will produce 1,500 to 3,000 plants. Ready for use in 100 to 160 days.

Carrots.—Sow early in loose, rich soil in rows 3 feet apart for horse cultivator or 1 foot for the hoe. The seed is small and slow to start. It should be covered lightly and pressed down firmly. If radish seed be sown in the same row they will break the surface and mark the rows so that relief may be given if the ground should bake. Thin to 4 inches apart in the row. Carrots are considered best when young and tender, and successive sowings will be necessary to supply them in that condition. One ounce will plant 150 feet of row. Carrots may be used in 70 to 120 days, varying with variety, management, etc.

Cauliflower.—This vegetable deserves more general cultivation in the farm garden. It can be raised with about the same soil, planting, and care as cabbage, but the supply of moisture must be maintained more carefully. The plants do not stand very hot weather. When the plants begin to head the loose leaves should be bent over to whiten the center. One ounce of seed will give 1,000 to 2,000 plants.

Celery.—Unusual care is necessary to grow celery, but it seldom fails to respond to proper treatment. Light, rich, and very fine soil is needed to plant the seed in, and a rich, peaty loam, "a sandy muck or mold, or any loam that is abundantly supplied with humus", is right for growing the celery to maturity.

Young plants may be bought, but it will frequently prove cheaper to grow them from the seed and they will then be stronger and thriftier. The seed should be sown early in the house or in a good hotbed. They require a very little covering of fine earth and some growers merely press them into the soil. A small box will give room for starting an abundance of plants. When the second leaves appear they should be transplanted $1\frac{1}{2}$ to 2 inches apart in large boxes, and as they begin to grow should be hardened by exposure to the open air and sun in the warm part of the day. When settled warm weather has come, May or

June, and the plants have made a growth of 5 or 6 inches, they should be set in the garden. It will be of advantage at this time to trim off the tops of the leaves and about one-fifth at the end of the main root. The ground must be thoroughly worked and fertilized with fine, rich compost, containing chicken manure if practicable. The plants are set in rows 3 to 4 feet apart and 5 to 6 inches apart in the row. It is practically impossible to make the ground too rich, and good stable manure seems to be most in favor for the purpose. As much as 2,000 pounds to the acre of a "high grade complete commercial fertilizer" may be used upon the soil already supplied with stable manure. The soil must be kept moist, and if it is not naturally so water must be turned on liberally. The soil must be loose both before and after transplanting and weeds kept down industriously. Cultivation must be especially careful until the celery has made a good start after the final transplanting.

Celery may be grown successfully by sowing the seed as directed, from April 1 to 15 in the central portions of the United States. A light mulch of fine hay or light litter over the seed will help bring it up. The young plants should appear in about two weeks. Then the mulch must be carefully removed.

When the plants are nearly grown they must be blanched. This is done usually by earthing up the stems gradually till only the tips of the leaves remain out. Great care must be exercised to keep the dirt out of the center. A method of blanching much in favor with progressive growers is by setting boards on each side of the row so as to shade it completely. This is especially successful with the so-called self-blanching kinds. Blanching by setting the plants very close and depending upon the stalks shading each other has not proved very successful so far. One ounce of seed will sow 100 feet of drill. Ready for use in 140 to 175 days.

Cucumbers.—A warm, light sandy soil well supplied with humus is recommended, while a hard, cold clay and any poor soil are unsuitable. Hills a foot deep and 4 to 5 feet wide should be prepared by thoroughly pulverizing the ground and mixing into it a liberal supply of stable manure and fertilizer. The only thing to be guarded against in fertilizing is the production of an excess of vine, with corresponding lack of fruit. This condition calls for pinching off the terminal buds. The hills should be 6 to 8 feet apart. Seed should be planted germ end down an inch and a half deep late in April. Weeds must be kept down carefully while the plants are young. When the vines cover the ground it is difficult to do anything with the weeds, because every movement is likely to injure the cucumbers. Many successful growers use trellises or frames.

It is best to start the cucumbers in the hotbed or in the house early in March. Sow on upturned pieces of sod 6 inches square and cover with an inch of light, rich soil. Transfer to the open ground early in May. Successional sowing should begin about the middle of May.

One to two ounces of seed will plant 100 hills. Ready for use in 50 to 75 days.

Ground cherry.—This plant (fig. 7), also known as strawberry or winter cherry, grows wild in the cornfields of the Mississippi Valley. Its fruit is used for preserves for the table. A good soil well worked improves the quantity and quality of its production. It may be planted early in drills 3 feet apart, with 12 to 18 inches between the plants in the drill.

It is recommended as very productive and as keeping through the winter in the husk.

Lettuce.—This plant is the most generally used in this country for salads. A warm mellow soil is required, with plenty of water and thorough weeding. Sow as soon as danger of severe frost is past. The seeds are very small and may be mixed with sand for sowing. They should be covered very lightly. In the Southern States it is usual to sow the seed broadcast and cover by drawing the fingers lightly through the soil, or to rake in with a light branch of a tree. The ordinary rake will cover too deeply. One kind, the cabbage lettuces, form heads naturally; the other, the Cos lettuces, do not head, but may be

blanched by tying up the leaves. Lettuce may be used in 3 to 4 weeks from planting. One-quarter of an ounce of seed will sow 100 feet of drill.

Martynia (fig. 8).—A rich, warm soil is needed. Plant when frost is gone for the year in hills 3 feet apart each way. The seed is slow to come up. One good plant to the hill is enough. The seed pods will be ready for pickling in 60 to 80 days and are put up in the same way as cucumbers. Half an ounce of seed will plant 100 hills.

Melons.—Both muskmelons (cantaloupes) and watermelons need a warm, rich soil; but care must be observed not to grow the vines at the expense of fruit by improper use

of fertilizing materials. Melons grow readily in a fertile sandy loam. The management is about the same as for the cucumber, but more light, heat, and air are needed and not so much moisture. The vines may be pinched back if they tend to run excessively. Muskmelons need 2 ounces of seed to the 100 hills; watermelon, 4 ounces. Muskmelons ripen in about 100 days from sowing the seed, watermelons in 120 to 140 days.

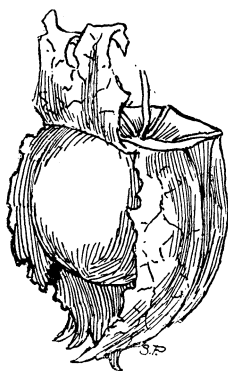


FIG. 7.—Ground Cherry.

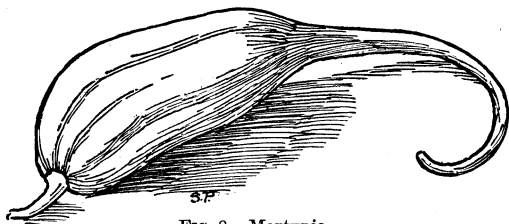


FIG. 8.—Martynia.

Okra.—A deep, rich soil well prepared is to be desired for okra, but it makes a thrifty growth and will do well with very little care after it has a good start, unless the season is very wet and cool. The seed does not come up with much certainty, and two or three plantings may be necessary. Seed should usually be procured fresh from a dealer every year, but with intelligent handling it may be saved from the pod. Okra should be planted as soon as frost is gone, in drills $2\frac{1}{2}$ to 3 feet apart and covered an inch deep. Thin to 12 or 18 inches as soon as the plants begin to grow well.

The pods are cut 3 to 5 days after the flowers fall, and are usually boiled alone or in soup with other vegetables. One and a half ounces of seed will plant 100 hills. Use of the pods may begin in 90 to 100 days from planting.

Onions.—A rich, deep, friable loam is the best soil. Sow early in shallow drills 1 to 3 feet apart, and cover with half an inch of well pulverized soil. Thin to 4 inches in the row. Keep down the weeds industriously. This will usually require working every ten days. Instead of sowing seed, the sets may be put out 4 to 6 inches apart in rows a foot apart. The ground does not then need to be so finely pulverized before planting. If the sets are put out in October they will furnish slender white stems for the table about two weeks from the beginning of growth in the spring. Onions well ripened keep well through the winter in a dry, cool place. One-third ounce of seed or 1 quart of sets go to 100 feet of row. Farmers' Bulletin No. 39 furnishes full details on onion culture. Ready for use in 100 to 110 days; ripe in 160 days, according to variety.

Parsley.—This is a biennial. Deep rich soil made very fine and mellow is best. Sow early in the spring in drills half an inch deep and a foot apart. Thin to 6 inches in the row, when the second pair of leaves appear. If wanted in early spring parsley may be sowed in September in a moderately fertile soil. During the cold weather the plants should be covered nearly to the top with leaves, held in place by brush. One-fourth of an ounce of seed will sow 100 feet of drill.

Parsnips.—This vegetable is grown precisely as the carrot (p. 18). It may be left in the ground all winter and dug as wanted. It is considered sweeter and better when managed in that way. One-fourth of an ounce of seed will sow 100 feet of drill. The roots are ready for use in 140 days from planting.

Peas.—Frost is not so fatal to peas as to beans, and the sowing may therefore be earlier. The soil, planting, and cultivation are practically the same as for beans (p. 17), but peas require a better soil and more attention. Some of the best peas grow tall and require sticks or wire to hold them off the ground. The half dwarf kind may be planted in close rows so that they will support each other. The seed does not come up with quite so much certainty as beans and the plant seems to suffer more by accidents and disease. Mildew is probably the worst

enemy, and is treated with Bordeaux mixture. (Footnote p. 17.) Weevil in the seed may be killed by soaking for an hour in a solution of an ounce of copper carbonate and a little less than a pint of ammonia to 1½ gallons of water. If peas are wanted for several weeks, successive sowings must be made or varieties judiciously chosen.

Two distinct kinds of peas are known, smooth seeded and wrinkled seeded. The latter are earlier and last longer; the former sometimes have edible pods and are known as sugar peas. One pint of seed will plant 100 feet of drill. Ready for use in 50 to 90 days, according to variety.

Potatoes.—A rich, sandy loam is the most favorable soil. It should be thoroughly loosened so that the tubers may grow freely. Plant as soon as frosts cease, about 3 inches deep, 12 to 18 inches apart, in rows 3 feet apart. The tubers are cut for planting so as to leave one or two eyes to each piece. Level cultivation is preferred. The weeds must be kept down, and when the potato bugs appear they must be killed promptly by a free use of Paris green or by brushing off by hand. A second planting, covered deeper, about May day will give potatoes for use in August, and a still later planting will furnish the fall crop. In digging and storing potatoes should not be much exposed to light. A peck of potatoes will plant 300 feet of row. For additional information regarding potatoes see Farmers' Bulletin, No. 35. Potatoes are ready for use in 85 to 135 days.

Radishes.—Among the first usually sown are radishes. They require little space and can be grown indoors. A loose, rich, deep soil, better if sandy, is required. The radish should grow very rapidly and be eaten while still very young. The drills are made 12 to 14 inches apart and the plants 3 inches in the drill. The seed should be covered about an inch deep. It comes up well, but should be planted thick and thinned promptly. Radishes are frequently sown broadcast and raked in lightly. Grubs sometimes destroy the roots. The only escape is to plant in soil where the grubs have not found lodgment. Frequent sowings will be made by those who enjoy fresh, crisp radishes. An ounce of seed will sow 100 feet of drill. Ready for use in 20 to 45 days, according to kind.

Rhubarb.—The soil should be deeply worked and rich, but the plant will grow with ordinary care upon any good ground. An open position, sheltered from east winds, is desirable. Bone meal and barnyard manure are recommended as fertilizers. Rhubarb may be grown by sowing the seed in the spring, but it is better to use the divided roots of old plants. They should be set 2 to 3 feet apart and may occupy an otherwise unused corner. Once set, it will produce for several years with very little attention. Use begins in the second season and must be discontinued in the summer in time to allow the plants to recuperate for the next year. An ounce of seed will sow 125 feet of drill.

Salsify.—The planting and cultivation are the same as for the carrots (p. 18), except that a little more space between the plants in the drill

will be an advantage. Salsify may be left out all winter if freezing is not very severe, but it is considered better to pull and store.

One ounce of seed will sow 100 feet of drill. Ready for use in 130 to 140 days.

Spinach.—For early use sow in a sheltered place in a dry, well prepared, fertile soil. Later the plants seem to need moister ground. If sown in the fall, spinach can usually be wintered under a mulch, which should be removed early in the spring. The drills should be a foot apart and the seed covered about an inch deep. Thin to 6 inches apart, and finally, as the plants grow, to 12 inches in the row. Gather two or three of the largest leaves as wanted from each plant as soon as they are large enough. Cut the heads when flower stems appear. New Zealand spinach is a new variety quite different from the common. The plants should stand 3 feet apart. Perpetual spinach is sown in rows a foot apart in very rich soil and thinned so as to give plenty of room. Half an ounce of seed is right for 100 feet of drill of the ordinary kind; 25 plants of the New Zealand is enough for a family. Ready for use in 25 to 35 days; New Zealand, 40 to 55 days.

Squash.—A warm, light, rich soil, deeply worked, is best. Plenty of stable manure will be repaid by increased yield. Plant summer varieties in slightly elevated hills, 4 feet apart each way, as soon as the ground is warm. Place the seed upright, with the eye down, and cover 1 to 3 inches deep. Late varieties should be planted in hills 6 to 8 feet each way, leaving four plants to a hill. Another way is to plant in rows 12 to 20 feet apart and thin to 6 feet between hills in the row. Early beans or peas may be cultivated between the rows, to be cleared away in July. Weeds must be kept down and moisture held by cultivation. The hand hoe must be used after the vines begin to run. Seed from the home garden is likely to be crossed with cucumbers or melons and the product unsatisfactory. One ounce of seed for summer and two ounces for winter will plant 25 hills. The summer squash may be used in 50 days; winter squash will be ripe in 115 to 125 days.

Sweet corn.—This crop requires much room and a rich soil, broken deep. It does not demand the careful pulverizing and loosening of the ground before planting which is usual in garden culture but will give better results for this and other generous treatment. Plant as soon as danger of frost is past in drills $3\frac{1}{2}$ feet apart, dropping three or four grains every 18 inches, or in hills $3\frac{1}{2}$ feet each way. Cover 2 to 4 inches deep. Keep the surface of the earth broken, so as to insure plenty of moisture and kill the weeds. For the garden the early sweet varieties are most useful. They will come to the table several weeks earlier than the large field kinds. Successional planting should be made, and about an eighth of an acre should give a constant supply of roasting ears for an ordinary family. One-fourth to one-half pint will plant 100 feet of drill. Corn should be ready for use in 55 to 85 days.

Sweet potato.—Warm, sandy, rather dry soil should be selected if available. Plants may be bought. If raised in the hotbed the old

potatoes should be buried 2 or 3 inches deep in the bed two or three weeks before the plants are wanted. When frost is gone set the young plants in well-manured rows 5 feet apart and 12 to 18 inches in the row. • Shallow cultivation is to be given, killing the weeds and keeping the soil loose. When the vines begin to run they must be laid aside before plowing. In some localities the crop is much injured if the vines take root in running, and this is prevented by moving them after other attention has ceased. Two to four plowings with the cultivator and one or two hoeings will be enough. They will be ready for use late in August, when a little more than half grown. They are taken from the hills as wanted without pulling up the vines. The potatoes are all dug when frost kills the vines. Five hundred plants will set from 350 to 500 feet of row. Additional information is given in Farmers' Bulletin No. 26.

Tomato.—A clayey soil is liked by some, sandy by others. Deep preparation and plenty of manure will make good tomatoes on almost any soil. Too much manure on a light soil may cause the plant to run to vine. Sow the seed in the hotbeds about the end of March, and set the plants when 2 inches high 3 feet apart in rows 3½ feet apart. They should not be set out till the temperature is likely to stay above 60°. This will usually be when oak leaves are well out of the bud.

Thorough cultivation, loosening the soil and killing the weeds, is necessary till the plants begin to spread and cover the ground. The soil should be drawn up to the plants in hills 2 or 3 inches high. Some support, as a trellis, is necessary to keep the fruit off the ground.

The fruit will begin to ripen in August, and should be picked as fast as ripe. The plant will usually continue bearing till frost, and if the full-sized green tomatoes are then placed under a cold frame or on the cellar floor they will usually ripen. One ounce of seed will produce 3,500 to 4,500 plants. Farmers' Bulletin No. 76, Tomato Growing, gives full details.

Turnips.—Rich finely pulverized soil is needed. A sandy or gravelly loam is preferred. The seed may be sown quite early, as the plants are not easily hurt by frost. Sow in drills 1 foot apart and half an inch deep, or sow broadcast and rake in lightly. If there should be no rain a thorough sprinkling will insure germination. The plants should stand at least 3 inches apart. Repeated sowings are necessary for a satisfactory succession in summer. White varieties are preferred for summer use.

For winter, sow late in July. A yellow kind is much liked. No cultivation is required when sown broadcast. Turnips may be stored the same as potatoes. The tops should be cut away. If covered with sand they will not wither, but may start to grow if the cellar is warm and will become pithy. Turnips mature in about two months. One ounce of seed is enough for 200 feet of drill.